

Title: A Dual-Task Paradigm Sensitive to Listening Effort in a Realistic Scenario.

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Abstract

Background: People with hearing loss often report that they need to invest a lot of effort when engaging in daily conversations, especially in noise. The dual-task paradigm has been used to quantify the amount of effort invested when listening. Under this paradigm, two tasks are performed concurrently, and performance in the secondary task is interpreted as a proxy of listening effort when the stimuli are presented in the time domain. This research aimed to develop a dual-task test paradigm sensitive to listening effort in a realistic scenario.

Methods: Five normal-hearing adults (3 females, [29-43] years) took part in the study. In the primary task, participants were asked to repeat matrix sentences presented in realistic cafeteria noise. The secondary task consisted of a visual task driven by the auditory stimulus of the primary task. Two vertical rectangles were shown on the screen, and in each trial, a large circle appeared in one of the rectangles at the onset of the auditory stimulus. Participants were instructed to press the arrow pointing towards or away from the circle if the name at the start of the sentence referred to a male or a female, respectively. Accuracy and reaction time were measured. The test was administered over headphones in quiet, -5 dB, and -10 dB SNR. The test was also administered using realistic 3D recordings in a 41-channel Ambisonics speaker array in an anechoic chamber, and these data will also be reported.

Results: For the five participants who completed the test under headphones, the mean accuracy scores in quiet, -5 dB, and -10 dB SNR were 99.6%, 88.4%, and 47.2%, respectively. Accuracy dropped by 11.2% from quiet to -5 dB SNR ($p=0.008$); and by 41.2% from -5 dB to -10 dB SNR ($p=0.0001$). The mean reaction times in quiet, -5 dB, and -10 dB SNR were 906 ms, 1083 ms, and 1254 ms, respectively. Reaction times increased 169 ms from quiet to -5 dB SNR ($p=0.0035$), and 201 ms from -5 dB to -10 dB SNR ($p=0.014$).

Conclusions: Preliminary results indicate that this dual-task paradigm is sensitive to increased listening effort in a realistic scenario. The observed effects on reaction time may be the result of the relative complexity of the test; the relative depth of cognitive processing required to categorize the gender of the name; and the fact that the primary and secondary tasks compete for the same pool of cognitive resources.